Plasma Membrane Changes in Avocado Postharvest Physiology

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The goal of this project is to build on our understanding of the basic physiology of avocado ripening. The relevance of this research to the avocado industry is principally long-term in that the new knowledge gained will help provide the background from which new strategies may be developed for prolonging avocado postharvest life.

The emphasis of our work has been on membrane proteins and the changes that occur in these proteins during ripening. Some of the plasma membrane proteins become more abundant during ripening, while others tend to disappear. To understand more about these changes and what they mean in relation to ripening, we are attempting to make antibodies that can be used as tools to help us study the particular proteins that change during ripening. Some of our attempts at antibody production have been successful, while other attempts have not been successful or are still in progress. Although we have been able to identify a number of plasma membrane proteins that change in abundance during ripening, we have not yet been able to determine the jobs that these proteins do during ripening. The exception is the protein called cellulase. Earlier workers have shown that cellulase is the protein that is principally and most directly responsible for softening of the fruit during ripening. Our work has shown that cellulase becomes associated with the plasma membrane during ripening.

We have used an antibody directed against cellulase to study how and when this protein appears in the fruit during ripening. The results indicate that cellulase first appears next to the seed at the bottom of the fruit and then continues to appear in a wave moving up towards the peduncle. As seen in the light microscope, cellulase appears just as the cell walls of the fruit begin to degrade and soften. As seen in the electron microscope, cellulase moves through the endoplasmic reticulum on its way to the cell wall and is especially prominent in and around the plasmodesmata. The path followed by cellulase on the way to the cell wall may be somewhat unusual since neither electron microscopy nor analysis of isolated organelle fractions provides convincing evidence of cellulase transport through the Golgi membranes.

These results on cellulase localization during ripening suggest that the earliest stages of softening begin at the bottom of the fruit, opposite the peduncle end. This information may be useful as regards proper packing to avoid damage to avocado fruits as they begin to ripen during long shipping runs.

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